

of this part. The design calculations must include the forces imposed by each of the following loads:

(1) An internal pressure equal to the MAWP less 1 bar (14.5 psig) in combination with the simultaneously applied loadings of 3W vertically downward, 2W longitudinally, and 1W laterally acting through the center of the tank (W is the maximum permissible weight of the loaded tank and its attachments), and the requirements of paragraphs (b) (4), (5) and (6) of this section;

(2) An internal pressure equal to the MAWP less 1 bar (14.5 psig), in combination with the simultaneously applied loadings of 1W vertically upward, 2W longitudinally, and 1W laterally acting through the center of the tank (W is the maximum permissible weight of the loaded tank and its attachment), and the requirements of paragraphs (b) (4), (5) and (6) of this section;

(3) The load on the tank head resulting from an internal pressure equal to the MAWP, less 1 bar (14.5 psig), in combination with the dynamic pressure resulting from a longitudinal deceleration of 2 "g", and the requirements of paragraphs (b) (4), (5) and (6) of this section;

(4) Loads resulting from any discontinuities between tank shell and heads;

(5) Superimposed loads such as operating equipment, insulation, linings and piping; and

(6) Reactions of supporting lugs and saddles or other supports.

(c) The shell thickness used in calculating the resulting stress levels in a tank shall be exclusive of any corrosion allowance.

[Amdt. 178-65, 46 FR 9895, Jan. 29, 1981, as amended at 66 FR 45387, Aug. 28, 2001]

#### § 178.270-5 Minimum thickness of shells and heads.

(a) For the purposes of this section, mild steel is steel with a guaranteed minimum tensile strength of 37 decanewtons per square millimeter (53,650 p.s.i.) and a guaranteed elongation of 27 percent or greater.

(b) Except as otherwise provided in this subchapter, the shell and heads of each portable tank constructed of reference mild steel:

(1) With a maximum cross-sectional dimension of 1.8 m (5.9 feet) or less, shall be at least 5 mm (0.197 inches) thick; or,

(2) With a maximum cross-sectional dimension exceeding 1.8 m (5.9 feet), shall be at least 6.35 mm (0.250 inches) thick.

(c) The minimum thickness of the shell and heads of each portable tank constructed of a steel other than the reference mild steel, shall be obtained from the following formula:

##### *Formula for metric units*

$$e_1 = (10e_0) / (Rm_1 A_1)^{1/3}$$

##### *Formula for nonmetric units*

$$e_1 = (112.3e_0) / (Rm_1 A_1)^{1/3}$$

where:

$e_0$  = Required thickness of the reference steel from §178.270-5(b)—millimeters (inches);

$e_1$  = Equivalent thickness of the steel used—millimeters (inches);

$Rm_1$  = Specified minimum tensile strength of the steel used—decanewtons per square millimeter (p.s.i.); and

$A_1$  = Specified minimum percentage elongation of the steel used—percent times 100 (i.e., if 20% use 20.0).

(d) When other than the standard minimum thickness for the reference mild steel is specified for a tank in this subchapter, the specified minimum shell and head thickness must be at least equal to the larger of the thicknesses calculated from the formula given in §178.270-5(c) and the following formula:

##### *Formula for metric units*

$$e_1 = (10e_0 d_1) / 1.8(Rm_1 A_1)^{1/3}$$

##### *Formula for nonmetric units*

$$e_1 = (112.3e_0 d_1) / 5.9(Rm_1 A_1)^{1/3}$$

where:

$e_1$  = Equivalent thickness of the steel used—millimeters (inches);

$e_0$  = The specified minimum shell and head thickness of the reference mild steel specified in the IM Tank Table—millimeters (inches);

$d_1$  = Actual outside diameter of the tank—m (feet);

$Rm_1$  = Specified minimum tensile strength of the steel used—decanewtons per square millimeter (p.s.i.); and



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A<sub>1</sub> = Specified minimum percentage elongation of the steel used—percent times 100 (i.e., if 20% use 20.0).

NOTE: For paragraphs (c) and (d) of this section the actual values for the tensile strength and percent elongation for the steel, as determined through tests on specimens from the group of plates to be used in the fabrication of the tank, may be substituted for the specified minimum values in the calculation prescribed in this paragraph (See § 178.270-3 of this part). Test records or certification of test results by the material producer or tank manufacturer must be retained by the tank manufacturer for a period not less than 15 years and must be made available to the Department or the owner of the tank.

[Amdt. 178-65, 46 FR 9896, Jan. 29, 1981, as amended by Amdt. 178-97, 56 FR 66284, Dec. 20, 1991; 57 FR 45465, Oct. 1, 1992; Amdt. 178-99, 58 FR 51534, Oct. 1, 1993; 66 FR 45387, 45389, Aug. 28, 2001]

## § 178.270-6 Tank supports, frameworks and lifting attachments.

(a) Each portable tank must be constructed with a permanent support structure that provides a secure base in transport. Skids, frameworks, cradles, or similar devices are acceptable. The calculated stress in tank supports, frameworks, and lifting attachments must not exceed 80 percent of the specified minimum yield strength of the material of construction under the applicable loading conditions specified in § 178.270-4(b).

(b) An IM portable tank that meets the definition of “container” in § 450.3(a)(3) must meet the requirements of parts 450 through 453 of this title, in addition to the requirements of this subchapter.

[Amdt. 178-65, 46 FR 9896, Jan. 29, 1981]

## § 178.270-7 Joints in tank shells.

Joints in tank shells must be made by fusion welding. Such joints and their efficiencies must be as required by the ASME Code. Weld procedures and welder performance must be ASME Code qualified or must be qualified by the approval agency in accordance with the procedures in the ASME Code, Section IX, Welding and Brazing Qualifications. A record of each qualification must be retained by the manufacturer for the period prescribed in ASME Code, Section VIII, Pressure Vessels,

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and must be made available to any duly identified representative of the Department and the owner of the tank.

[Amdt. 178-65, 46 FR 9896, Jan. 29, 1981; 46 FR 24184, Apr. 30, 1981]

## § 178.270-8 Protection of valves and accessories.

Each valve, fitting, accessory, safety device, gauging device, and other appurtenance shall be adequately protected against mechanical damage.

[Amdt. 178-65, 46 FR 9896, Jan. 29, 1981]

## § 178.270-9 Inspection openings.

Each portable tank must be fitted with a manhole or other inspection opening sited above the maximum liquid level to allow for complete internal inspection and adequate access for maintenance and repair of the interior. Each portable tank with a capacity of more than 1894 L (500 gallons) must be fitted with an elliptical or round manhole at least 279 × 381 mm (11 × 15 inches), or 254 × 405 mm (10 × 16 inches), or with a circular manhole at least 381 mm (15 inches) in diameter. Any inspection opening and closure must be designed and reinforced as required by the ASME Code.

[Amdt. 178-65, 46 FR 9896, Jan. 29, 1981, as amended by Amdt. 178-104, 59 FR 49135, Sept. 26, 1994; 66 FR 45387, Aug. 28, 2001]

## § 178.270-10 External design pressure.

(a) Each portable tank not fitted with vacuum relief devices must be designed to withstand a positive external pressure differential of at least 0.4 bar (6 psig).

(b) Each portable tank fitted with vacuum relief devices must be designed to withstand a positive external pressure differential not less than the set pressure of the vacuum relief device and in any case at least 0.21 bar (3 psig).

[Amdt. 178-65, 46 FR 9896, Jan. 29, 1981, as amended at 66 FR 45387, Aug. 28, 2001]

## § 178.270-11 Pressure and vacuum relief devices.

(a) *Relief devices required.* Each portable tank, or each independent compartment of a portable tank, must be fitted with pressure relief devices in accordance with the following: